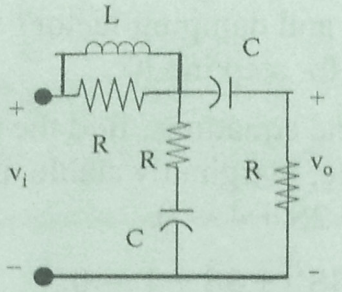
Tanta University

Department: Computers and Automatic Control
Total Marks: 90 Marks

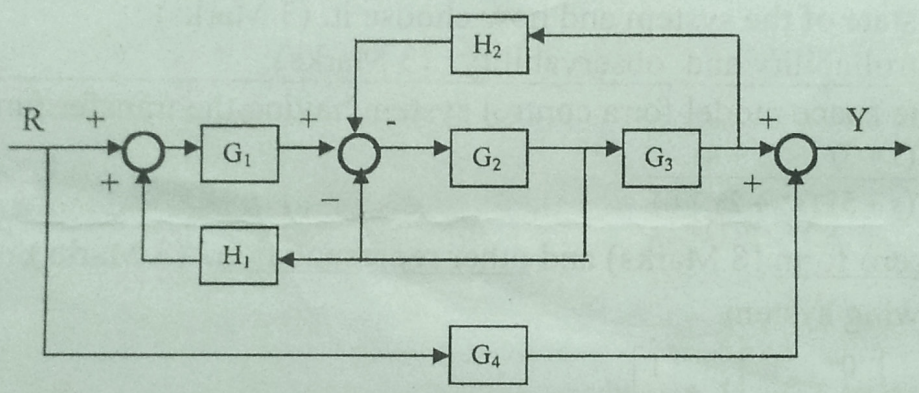
Faculty of Engineering

Course Title: Signals and Systems	Course Code: CCE 2210	Year: 2nd
Date: June 2014	Allowed time: 3 hrs	No. of Pages: (2)

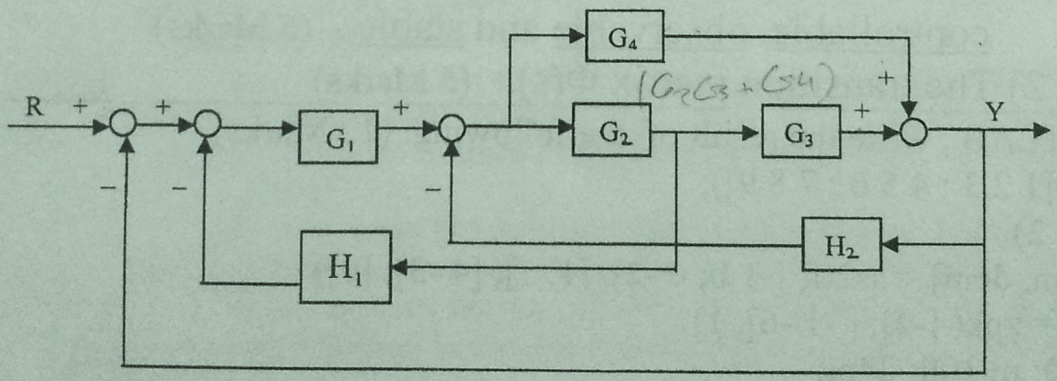
Q1) a) Find the mathematical model (transfer function) of the following system. (8 Marks)



b) Determine the transfer function using signal flow graph. (8 Marks)

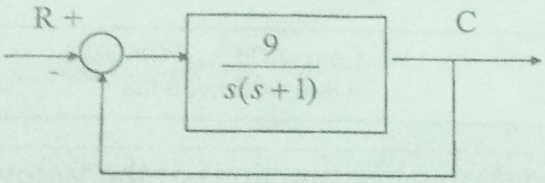


c) Determine the transfer function using block diagram reduction. (8 Marks)



$G_1 \quad G_2 \quad G_3$

Q2) [a] For the following system: (10 Marks)



1) Find the type of the system and the order?
2) Determine the natural frequency and damping factor?
3) Determine the steady state error for step input?

[b] For each of the following characteristic equations, find the root distribution and determine whether the system is stable, marginally stable, or unstable: (12 Marks)

i) $S^6+S^5+2S^4+2S^3+3S^2+2S+4=0$

ii) $S^7+3S^6+3S^5+S^4+S^3+3S^2+3S+1=0$

iii) $S^5+2S^4+2S^2+3S+7=0$

Q(3): 1- Explain three properties of the system and give an example for each. (5 Marks)
2- Define the state of the system and how choose it. (3 Marks)
3- Define controllability and observability. (3 Marks)

Q(4): [a] Find a state space model for a control system having the transfer function:

$$G(s)=\frac{(s+3)}{(s+5)}\frac{(s+4)}{(s^2+2s+6)}$$

in the pole-zero form (8 Marks) and other representation. (3 Marks)

[b] For the following system

$$\dot{\underline{X}}=\begin{bmatrix}0 & 1\\ -5 & -6\end{bmatrix}\underline{X}+\begin{bmatrix}1\\ 2\end{bmatrix}u$$

$$y=[4 \quad 1]\underline{X}$$

Find : 1) Determine whether the system in (b) is completely state controllable, observable and stable . (5 Marks)

2) The transition matrix Φ(s). (5 Marks)

Q(5): In MATLAB , write the result of the following: (12 Marks)

a) >> A =[1 2 3 ; 4 5 6 ; 7 8 9]);
>> A(:,2)

b) >> [num, dem] = ss2tf([-1 0; 0 -2], [1; 1], [4 -3], [0])

c) >> sys = zpk([-4], [-1 -6], 1)

d) >> x= 0: pi/100: 2*pi;
>>y =sin(x);
>>plot(x,y)
>> xlabel ('x = 0 : 2\pi ');
>> title ('plot of the sine function')

Course Examination Committee

Dr: Mohamed Ahmed Shoaib